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OREGON PINE IPS GENERATIONS IN THE NORTHERN REGION 1962-1963

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The Oregon pine ips beetle, Ips oregonis (Eichh.), (fig. 1), attacks and raises its broods in pines. This beetle develops high populations in ponderosa pine logging slash and weakened trees. Ordinarily, they are secondary insects that initiate the breakdown of logging debris and slash, and are of some benefit. Periodically they become primary tree killers and destroy great numbers of apparently healthy trees. During these periods they cause intolerable losses in ponderosa pine and to a lesser extent in lodgepole pine timber stands.

Sources of these periodic outbreaks are logging, land-clearing, and thinning debris. Tree mortality from ips beetles is a very serious economic problem. In thinning ponderosa pine stands, they can be a real hazard to the residual trees; management plans can be affected and fire hazard created. During outbreak years, large groups of trees are attacked and killed many miles distant from logging or thinning areas.

Despite studies on the biology of Ips oregonis, its habits are not well known. Why does it periodically develop into a tree killer? Is it a matter of population buildup? Weather conditions? Or is it lack of host resistance which could be associated with weather?

The year 1961 was a disastrous year from the standpoint of ips damage. Hundreds of thousands of ponderosa pine trees were killed near Grangeville, Idaho, (fig. 2); tree killing was evident throughout the ponderosa pine timber type in the Northern Region. In Montana, numerous large groups of dead trees, some of more than a thousand, occurred in the Bitterroot Valley and near Missoula. There were very few trees killed by ips in 1962 or 1963.

word?

Weather-wise, 1961 was unusual in that it was very warm and dry during June, July, and August in the areas where ips damage occurred. If weather is the key to ips outbreaks, it is doubtful if summer rainfall is important because the areas listed do not ordinarily have much rain during the summer.

contradict.

Figure 3 shows the average monthly temperatures for 1961, 1962, and 1963 compared to the long-term mean for four locations where heaviest ips damage occurred. There is a strong implication here that unusually high temperatures for June, July, and August are associated with ips outbreaks. However, this may or may not be true; other factors may be of greater importance. Only a well-planned study of the biology of this insect can determine the cause of these disastrous outbreaks.

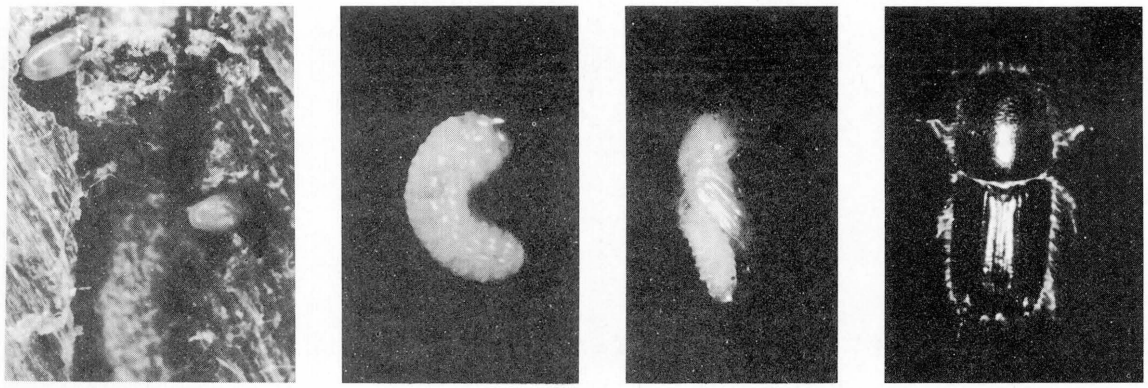

Figure 1.--Stages of ips development about eight times showing eggs, larva, pupa, and adult beetle.

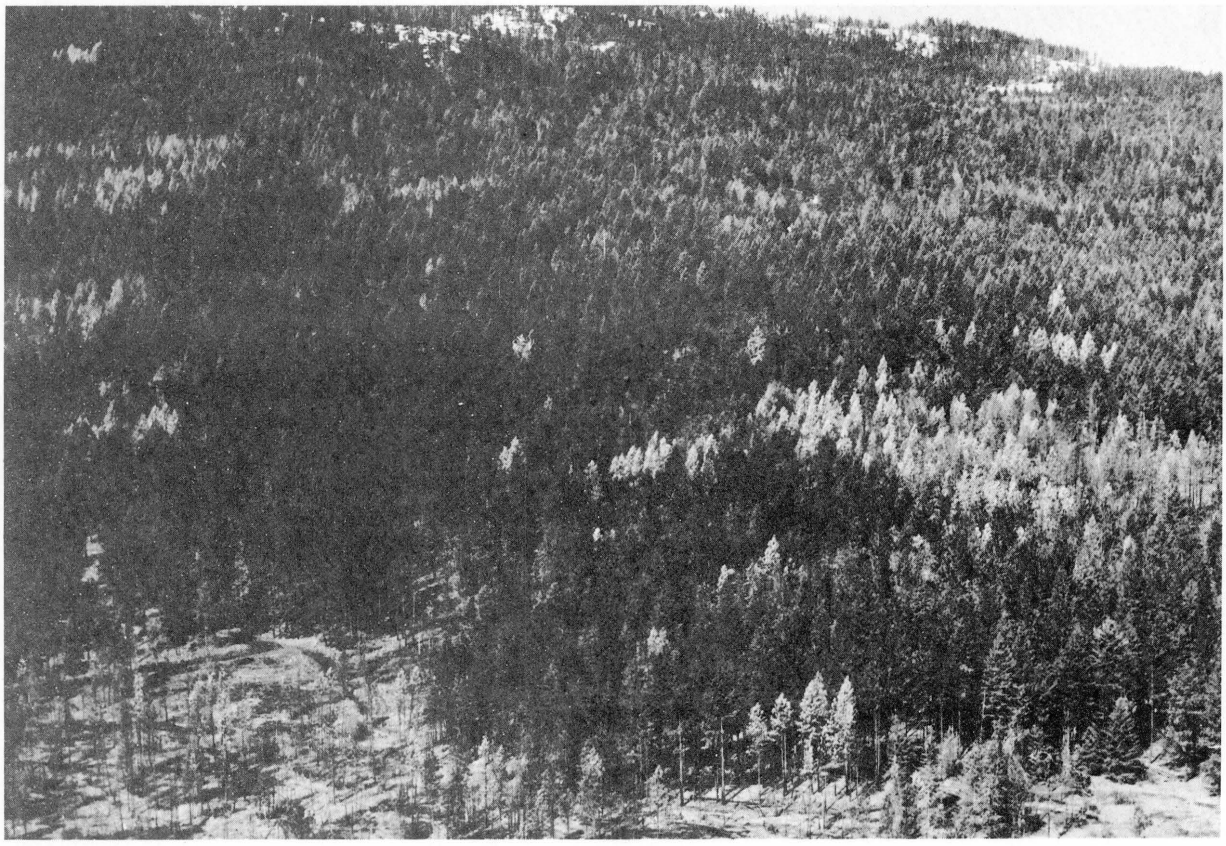

Figure 2.--Groups of vigorous 60- to 80-year-old ponderosa pine killed by ips in 1961 near Grangeville, Idaho. Many townships of timber land were as heavily attacked in this area.

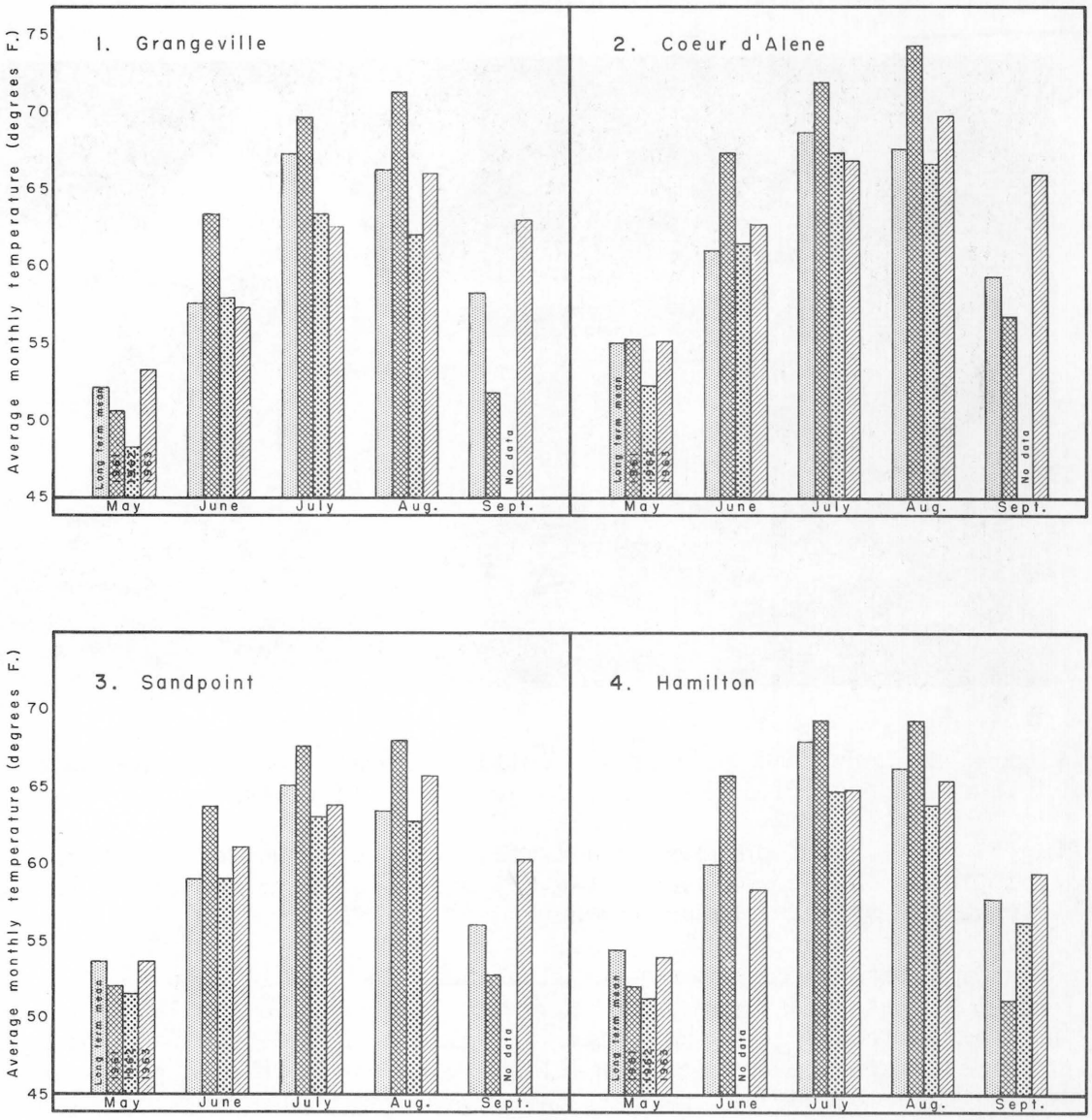

Figure 3.--Temperature records from: 1, Grangeville; 2, Coeur d'Alene; 3, Sandpoint, Idaho; and 4, Hamilton, Montana for 1961-1963 compared to the long-term mean.

To enable forest insect survey technicians to make meaningful biological evaluations during the summer season, Ips oregonis broods were caged during 1962 and 1963. This work was done to determine the number of generations of beetles during these seasons.

In 1962, three cages (fig. 4) were set up in the Nezperce Forest near the Castle Creek Work Center. Because elevation was thought to have some influence on ips generations, the cages were located at about 1,000-foot elevation intervals.

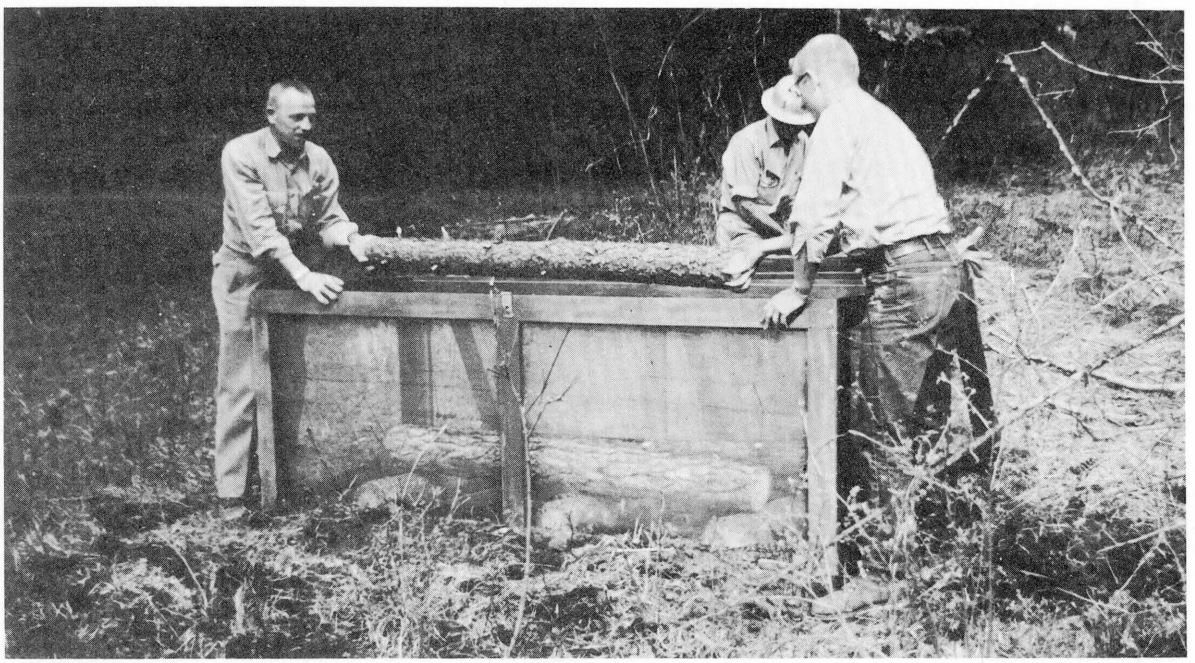

Figure 4.--Cage used to rear ips beetle generations. Infested logs were placed on peeled billets to hold the logs off the ground.

Cage 1 was 2,386 feet above sea level, cage 2, 3,466 feet, and cage 3, 4,516 feet. All three cages (fig. 4) were placed in similar south to southwest partially shaded exposures.

Freshly attacked ponderosa pine slash near the middle cage was cut into 4-foot billets and three were placed in each cage on April 24. At the same time, freshly cut trap logs were placed in the cage to attract and trap reemerging parent adult beetles. When the most advanced stage of brood in the brood logs reached the pupal stage, the trap logs were removed and three fresh-cut logs were placed in the cage to be hosts for newly-developed emerging brood. Brood logs were examined weekly or oftener to determine development. Trap logs and new brood logs were placed as each generation developed through the summer. Thermographs were placed at each cage to record the daily temperatures.

The results of brood development were a surprise. Brood development in all three cages was slow. In both the lower and middle cages brood dwindled to a low population. By late June pupae were found and teneral adults developed by mid-July. A few of these emerged and attacked logs placed in the lower cage, but no brood developed from these attacks. Brood did remain in the first logs all summer. In the middle cage there was some brood development in the second set of logs.

In the upper cage, although the initial brood was started from the same source as in the lower and middle cages, brood development was slower at first. A green tree cut near this cage was not attacked by native ips until early July. By late July, however, brood development in this cage was about equal to that in the other two cages. In mid-July a few new adults from the first generation started to attack the second set of logs. On August 6 a few more attacks were made. Brood from this attack developed into pupae and callow adults by October 2 when the cages were dismantled.

From this, it is clear that only one generation was completed and second generation brood did not fully mature. And much of the first generation stayed in the original logs all summer except in the upper cage. During this period most of the brood died in the lower two cages.

In the lower cage 109 days elapsed from egg to adult; in the upper cage the time was 102 days. Because so few brood remained in the middle cage, no definite period was recorded. After 1 month the thermograph in the middle cage stopped functioning and was removed. Records from the lower and upper cages indicate 2,378 hours and 2,082 hours ~~about~~ above 40 degrees F. occurred during development of egg to emerging adult. This information appears to be of little value considering the poor vigor of the broods.

Elevation seemed unimportant.

In 1963, two cages were used to check the number of generations of Ips oregonis. One cage was set up near the Ninemile Ranger Station, Lolo National Forest, about 25 miles west of Missoula, Montana. The second cage was located at the Fernan Ranger Station, Coeur d'Alene National Forest, Coeur d'Alene, Idaho.

In 1963, overwintered ips attacked ponderosa pine slash on April 30 near Coeur d'Alene, and on April 28 near Ninemile. At Ninemile three generations developed while four developed at Coeur d'Alene. In both instances the last generation mostly stayed on the host logs in which they developed. The logs were removed from the Coeur d'Alene cage January 12, 1964. The brood was in the larval and pupal stages September 30, but most matured to adults by January 12. Surprisingly, a few live pupae and many dead ones were found when these logs were examined in January.

The logs were removed from the Ninemile cage February 14. All the brood was in the callow or teneral adult stages. There were numerous emergence holes, but only one entrance hole in fresh logs placed in the cage in mid-September.

Examinations of brood development were not made often enough to give a precise record of the number of days required to complete each generation. The following tabulation is only approximate:

	Coeur d'Alene	Ninemile
First generation	43 days	50 days
Second generation	35 days	32 days
Third generation	33 days	70 days
Fourth generation	50 days	

The periods for Coeur d'Alene compare well with records kept by Henry J. Rust in 1935[1/] where he shows 58, 38, 35, and 50 days for each of four generations.

A change was made in the technique of handling caged material in 1963 from that used in 1962. In 1962 and 1963 newly infested logs were placed in the cages as soon as they were normally infested by overwintered ips in the spring. In 1962 uninfested trap logs were also placed in the cages to attract reemerging parent adults. The cages were then closed. When the most advanced brood were pupae, the trap logs were discarded and freshly-cut logs were placed in the cage to serve as host for emerging teneral adults. The time lapse between pupal and adult stage gave the new host material a week or two to age. This process was to be continued through the subsequent generations.

In 1963 no trap logs were placed in the cage, but instead the cages were left open to permit the reemerging parent adults to escape. When the most advanced brood became pupae, new host logs were placed in the cages and the cages were closed until the emerging teneral adults had attacked the new host material. The cages were then opened and the old host logs with remaining brood were discarded. The cages were again left open as before. This system was repeated for each generation, and proved less complicated than that used in 1962. Also leaving the cages open between the egg and pupal stage provided a more natural condition than possible in closed cages.

All broods were vigorous in 1963 in contrast to those in 1962.

From these 2 years of caging ips to determine the number of generations, it is apparent that there are varying numbers of generations from year to year and even in the same year in different localities. There also appear to be vigorous broods and low vigor broods.

1/ Rust, H. J., The Biology of Ips oregonis and Associated Insects in Idaho, Final Report. 1935. Unpublished. In files of Forest Insect Research, Intermountain Forest and Range Experiment Station, Missoula, Montana.

Although it is erroneous to draw presumptuous conclusions, it is possible that ips beetles are affected by some genetic change following outbreak years or some other factor that lowers their vigor. During the succeeding years, they may build up in vigor and maintain a high potential until a favorable season such as that in 1961 occurs. The coincidence of a high brood potential and a favorable season may bring about the periodic "ips years" when catastrophic losses occur in ponderosa pine stands.

A well-designed study is needed to determine habits of Ips oregonis as it is related to its environment, weather, and natural controlling influences - a study that will indicate when ips beetle potential is a hazard. Thinning and slash treatment plans could then be adjusted accordingly.